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Antibacterial Activity of Four Different Varieties of Green Beans

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ABSTRACT

In the present study we compared the antibacterial activity of four varieties of green beans. Fresh extracts of pods of Phaseolus vulgaris (french beans), Vicia faba (broad beans; saem), Cyamopsis tetragonoloba (cluster beans; guar) and Vigna unguiculata (cowpea; lobia) were tested against two human pathogenic bacteria: Escherichia coli (gram negative) and Bacillus subtilis (gram positive) using disc diffusion assay. The streptomycin was used as the control. The results showed that all the extracts possess antibacterial activity (bacteriostatic activity). The range varied from 9 mm to 15 mm against E.coli and 10 to 12 mm against B. subtilis.

Keywords: Green beans; antibacterial; bacteriostatic; E.coli; B.subtilis

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INTRODUCTION

Plants consisting of wide variety of chemical compounds offer a promising source of new antimicrobial agents [1-3]. Reports are present on the presence of anti-microbial compounds in various plant parts like leaves, bark, fruit, root and flowers [4, 5]. The use and search for drugs and food supplements obtained from natural sources like plant extracts have increased in recent years [6]. This may be due to the increased problem of microbial resistance and therefore outlook for the use of antimicrobial drugs in the future is still uncertain [7]. As a rich source of secondary biomolecules which exhibit significant pharmacological effects, herbs appeal to many consumers who are concerned with the safety of synthetic food additives [8]. Plant extracts and essential oils have been used as alternatives to antibiotic due to their antimicrobial activities and the favorable effect on the animal intestinal system [9].Usage of herbs have gained importance due to their cost effective and eco-friendly attributes [10].

Bean is a herbaceous plant from the Leguminosae (fabaceae) family. Because of its nutritional qualities, beans can successfully replace meat. Its rich containment of proteins (approximately 70% of the necessary amino acids which can be found in meat), carbohydrates and the lack of toxins, it is best recommended for its beneficial effects on health. Green beans contain about twice as much iron than spinach. Besides its proteic content, bean also contains organic and mineral substances (sodium, potassium, calcium, magnesium, silicium, nickel, copper, and cobalt), vitamins (A1, B1, B2, B5, B6, C, E, K and P1). Green beans are an important source of both carotenoids and flavonoids. Green bean carotenoids include lutein, beta-carotene, violaxanthin, and neoxanthin. Green bean flavonoids include quercetin, kaemferol, catechins, epicatechins, and procyanidins [11-13]. Bean also contains fibers (soluble and insoluble) with an important role in the body: it reduces the level of cholesterol, prevents constipation and colon cancer. Bean also benefits the immune system through its anti-infectious effect which facilitates the growing of the number of leucocytes, destroying injurious microorganisms in the body. This effect is present because of chromium - a substance present in beans with the role of stimulating lymphatic ganglions [13].

In present study, the antibacterial activity of crude extracts of green pods of four varieties of fresh beans has been studied as part of the exploration for new and novel bio-active compounds that can be used as food supplements.

MATERIAL AND METHODS

Plant material collection

The pods (whole fruit) of four varieties of beans namely - French Beans (Phaseolus vulgaris), Broad Beans (Vicia faba), Cluster Beans (Cyamopsis tetragonoloba) and Cowpea Beans (Vigna unguiculata) were taken from local vegetable market of New Delhi, India. Samples were identified & authenticated by Department of Botany, CCS University, Meerut.

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Preparation of extract

The collected beans were washed with distilled water and dried using blotting paper. The extensions and the tips of the fruit were trimmed and it was cut into small pieces. The pieces were crushed using a grinder. 10 gm of the crushed beans were weighed and passed through muslin cloth to obtain the crude extract. The filtrate was centrifuged at 3000rpm for 10mins to remove any debris. The supernatant was collected and used for further experiment.

Bacterial Strains

Bacterial culture of Bacillus subtilis (MTCC 121) and Escherichia coli (MTCC 433) were procured from Institute of Microbial Technology, Sector 39A, Chandigarh, India. The bacterial culture was maintained on nutrient broth (NB) at 4^0C in our laboratory.

Preparation of inoculums

The gram positive (Bacillus subtilis) and gram negative (Escherichia coli) were precultured in nutrient broth overnight in a rotary shaker at 37°C for E. coli and 30°C for B. subtilis .The cultures were used when A_{600} of 0.6 was obtained.

Antibacterial assay

Antibacterial activities of the different extracts were investigated by the disc diffusion method [12]. The test microorganisms were seeded on NAM (nutrient agar media) plates by spread plate method; 100µl containing 10^6 colony-forming units (CFU)/mL. On solidification the filter paper discs (6.0 mm diameter) impregnated with each extract were placed on test organism-seeded plates. Streptomycin (30 µg/mL) was used as control. All the plates were incubated for 18 to 24 h at 37°C for E. coli and 30°C for B. subtilis. The zones of growth inhibition around the discs were measured after 18 to 24 h of incubation [14]. The sensitivity of the microorganism species to the plant extracts was determined by measuring the sizes of inhibitory zones (including the diameter of disc) on the agar surface around the discs. All of the experiments were performed in triplicate. The results were recorded as the average of three experiments.

RESULTS AND DISCUSSION

Plants are a potential source of therapeutic activities due to the presence of bioactive components. Many reports are available on the antiviral, antibacterial, antifungal, antihelmintic, antimolluscal and anti-inflammatory properties of plants [15, 16, 17]. These studies have helped in identifying the active principles which can be explored for developing drugs for the therapeutic use in human beings. However, not many reports are available on the therapeutic uses of pods of green beans.

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In present study, first time we have reported that fresh extracts of pods of Phaseolus vulgaris, Vicia faba, Cyamopsis tetragonoloba and Vigna unguiculata showed antibacterial activity against E. coli and B. subtilis (Table 1). When tested by disc diffusion method, extract of P. vulgaris showed significant antibacterial activity against E. coli (15 mm). Extract of V. faba exhibited highest activity against B. subtilis (12 mm). Extract of V. unguiculata showed higher inhibitory activity against B. subtilis than E. coli. Extract of C. tetragonoloba showed almost similar zone of inhibition (10 mm) against both the tested bacteria. The antibacterial activitiy of the extracts were compared with standard antibiotic streptomycin.

Table1: Antibacterial activity of green bean extracts against bacterial species tested by disc diffusion assay.

Extracts	Zone of inhibition (mm)	
	E. coli	B. subtilis
Streptomycin	23 ± 0.33	20 ±1.20
P. vulgaris	15 ± 0.88	11 ± 0.57
V. unguiculata	09 ± 0.33	10 ± 0.33
C. tetragonoloba	10 ± 0.57	10 ± 0.33
V. faba	11 ± 0.79	12 ± 0.88

Values are represented as mean ± SD of triplicates

Comparative antibacterial activity of all the four varieties of beans is shown in figure 1. For activity against E.coli , P. vulgaris (french beans) showed highest activity followed by V. faba (seam), C. tetragonoloba (guar) and V. unguiculata (lobia). But for activity against B.subtilis highest activity was shown by V. faba (seam), followed by P. vulgaris, C. tetragonoloba and V. unguiculata.

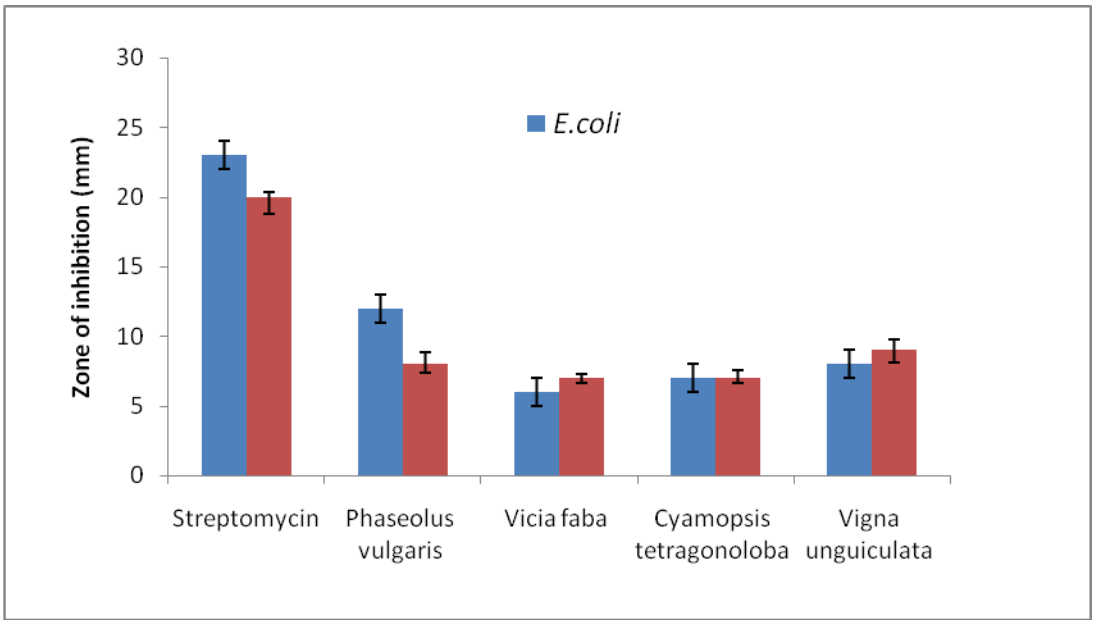

Figure 1: Comparative study of antibacterial activity of green bean extracts.
Values are represented as mean ± SD of triplicates

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CONCLUSION

From these findings it may be concluded that, green beans which form a major component of the dietary consumption, possess some antibacterial activity against both gram positive and gram negative bacteria. Hence beans can be used as health protecting factor. The bio-guided purification can be used to isolate the active compound responsible for the activity. The work is under progress in our laboratory.

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